# Run 2B Pbar Collection-Aperture

- Collection of the secondaries beam off the production target.
- Involves both AP2 and Debuncher
- Sub projects:
  - Alignment
  - Orbit control
  - Opening/Moving Physical Limitations
  - Diagnostics

# Re-write of Goals/Milestones

- Verify collection model with beam measurements
- Decide design strategy

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- List items (rebuild, move, motorize, survey)
- Develop design and installation schedule
- Fabricate Components
- Install Components

- Decide diagnostics needs
- Implement instrumentation

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- Decide optics design
- Verify optics with beam

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- Develop studies plan for beam based alignment

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- Develop studies for identification of lattice upgrades

# Verify Model

- Lebedev studies shows Aperture improvement has bigger gain than Lens Gradient.
- AAC suggests that this be verified.
- *Conflict* between studies and old measurement
  - Lens Gradient study included Target-Lens distance change and some re-tuning/re-steering.
  - OptiM study included optimizing Target-Lens distance & AP2 lattice optics with perfect steering.

# Lens as part of AP2

- The Lens is steering beam
  - Change lens gradient and the secondaries beam positions on AP2 SEMs move.
    - Horizontal effect much greater than Vertical
    - Appears to perform some of the PMAG $3^{o}$ bend
- Need to remove Lens steering
  - Short tests result in decrease of pbar production
  - Will need to re-steer AP2 line
    - New HT704 and Left Bend shunts; VT704 soon?
    - Several shifts to re-steer; will affect stacking rate but should result in same, or better, pbar production rate

# Horizontal Re-Steering of AP2

- Stacking mode of operation
- Use SEMs to monitor positions
- Quad Centering technique
  - Vary current and monitor position
    - No movement: orbit through center of element
  - Perform on Lens and first 6 Quads
  - Steer using HT107, PMAG, HT704 and H704

# Aperture Measurements

- Use the Debuncher scrapers at known βs
  - Measure Debuncher aperture with reverse protons
  - Assuming that the Debuncher has a larger aperture than AP2, then during stacking slowly move Debuncher scraper to find edge and extinguishing points to determine *AP2 aperture for antiprotons*
    - Make sure only measuring antiprotons (end of stacking cycle measurement)

# AP2 Scrapers to Define Aperture

- While stacking, move scraper until stacking is affected by 5-10% (record position).
- Do single scraper of pair at a time.
- For each pair, determine where they meet.
- Move all scrapers to recorded positions and now the AP2 aperture is defined.
  - Can always close scrapers more to define a smaller aperutre.

# Lens Gardient Measurement

- Required:
  - No Steering by Lens
  - AP2 Scrapers to define the AP2 aperture
- Measure pbar production as a function of Lens Gradient
- Re-do with smaller aperture
- Cross check aperture with Debuncher scraper measurement
- Compare with model

# Similar Measurments

- Similar requirements and procedure as for Lens Gradient:
  - No Lens steering, AP2 aperture defined by scrapers, measure pbar production rate.
- Vary  (one at a time)
  - Proton Beam size on target
  - Timing of Lens pulse
  - Chord distance through target
  - etc.
- Compare with model

# Phase Space off the Target

- Use two pairs of scrapers in the same plane to perfrom Raster scan
  - Set 1mm opening of one pair of scrapers and then move 1mm opening of a second scrapers; record rates.
- With optics, propagate results back to target and determine initial distribution

# Orbit Control Status

- AP2 Trims and shunts
  - HT704 and Left Bend shunts in place; elements have been barely exercised.
  - Prep work for VT704 is occurring.
  - Future trims for injection region control.
- Debuncher Motorized Quad Stands
  - 10 stands are prepared.
  - Little items (bellows) left to be fully prepared.
  - Time for installation (~2 shifts/stand & vacuum recovery); looking at summer shutdown.

# Work to do Lattice Measruements

- Closed orbit 1-bump measurments in Debuncher
  - Use current BPM system to make initial measurements
  - DRF3 is being setup to bunch beam for BPMs & to change energy; 1-bumps at different energies
- 1-bump measurements to measure AP2 lattice
  - Need to trigger AP2 BPMs for reverse protons
  - Need to develop DRF1 Adiabatic cavity curves to send 53MHz beam up AP2
  - Cross check BPMs with SEM positions
  - Use DRF3 and DRF1 to send different energy beam
  - Target station dual-BPM is being fabricated to complete the coverage of AP2 line for reverse protons

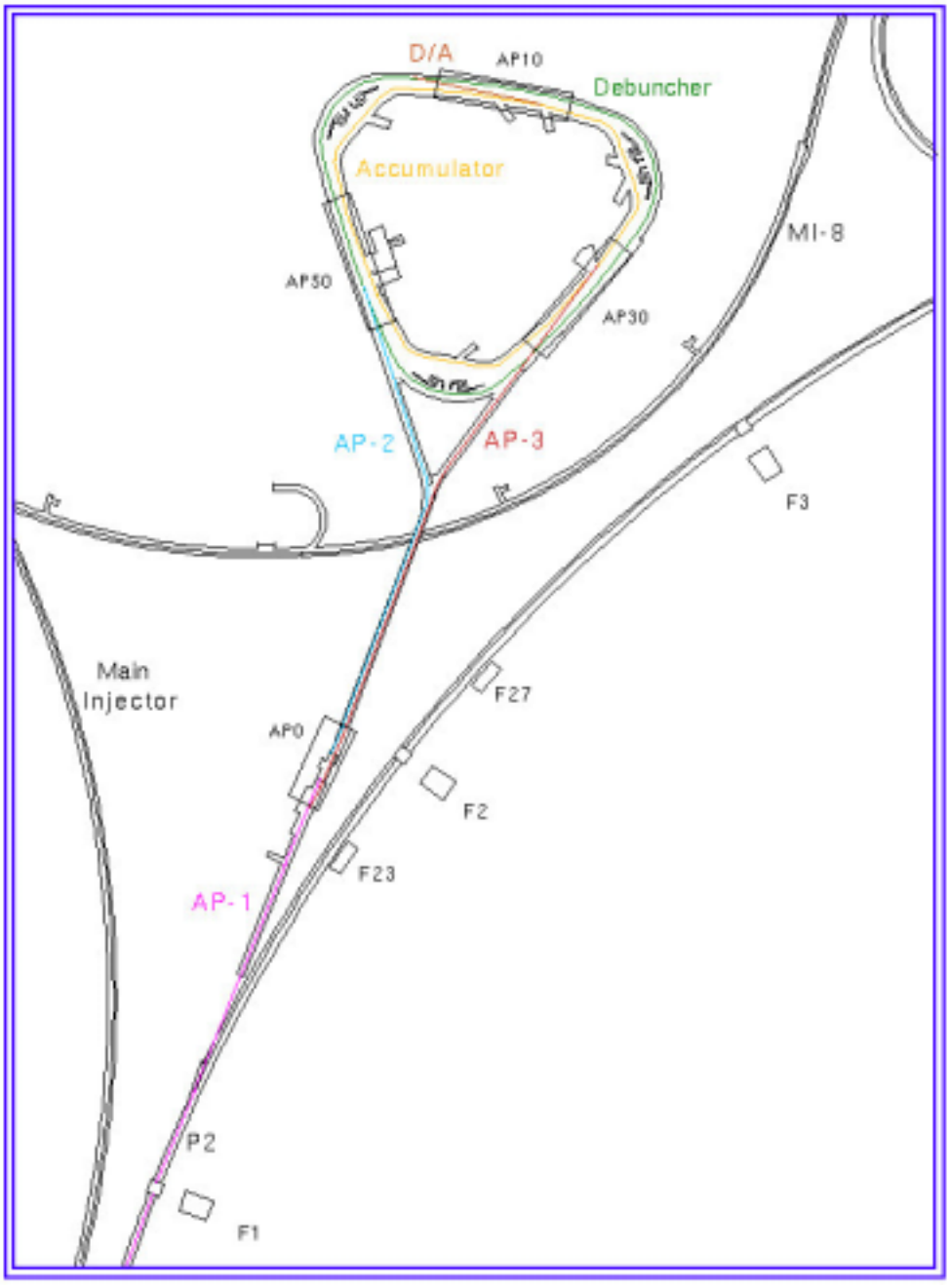
# BPM Electronics & DAQs

- Debuncher Closed Orbit Electronics & DAQ
  - Single BPM test within a few weeks (pre-amp, log detector and switching system)
  - Deciding Front-end system and implementation
  - Java OAC and console app in development
- AP2 Beamline BPM DAQ
  - Deciding Front-end system and implementation
  - Java OAC and console app to be developed
  - Ethernet pulls to F23 and F27 need to be planned

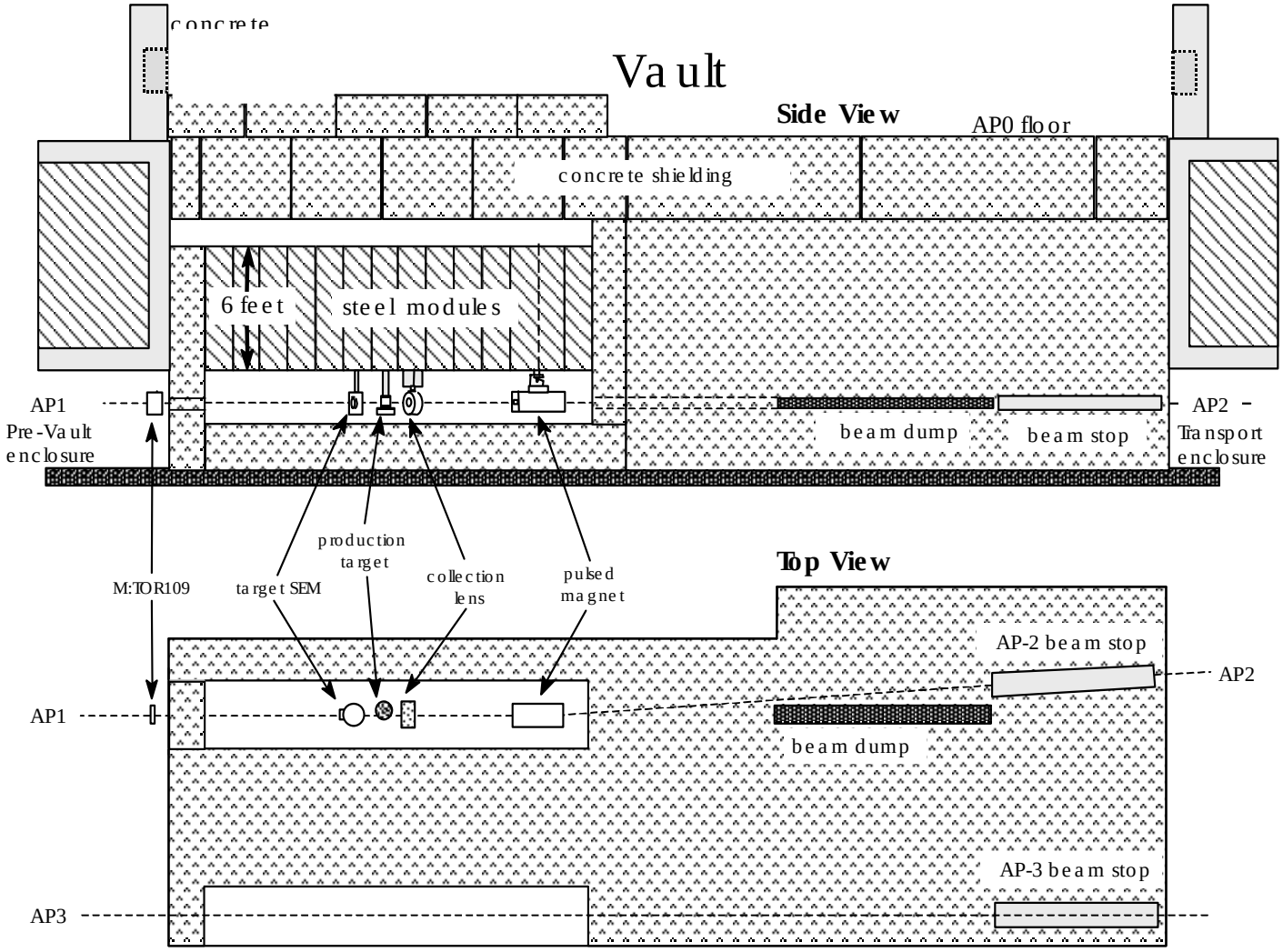
# Identifying Physical Apertures

- Need to check all elements
  - Location
  - Beam pipe size
  - Alignment
  - Determine expected beam size with each component
- Determine Which *Re* to do
  - Re-design, Re-build, Re-locate
- Plan and Implement

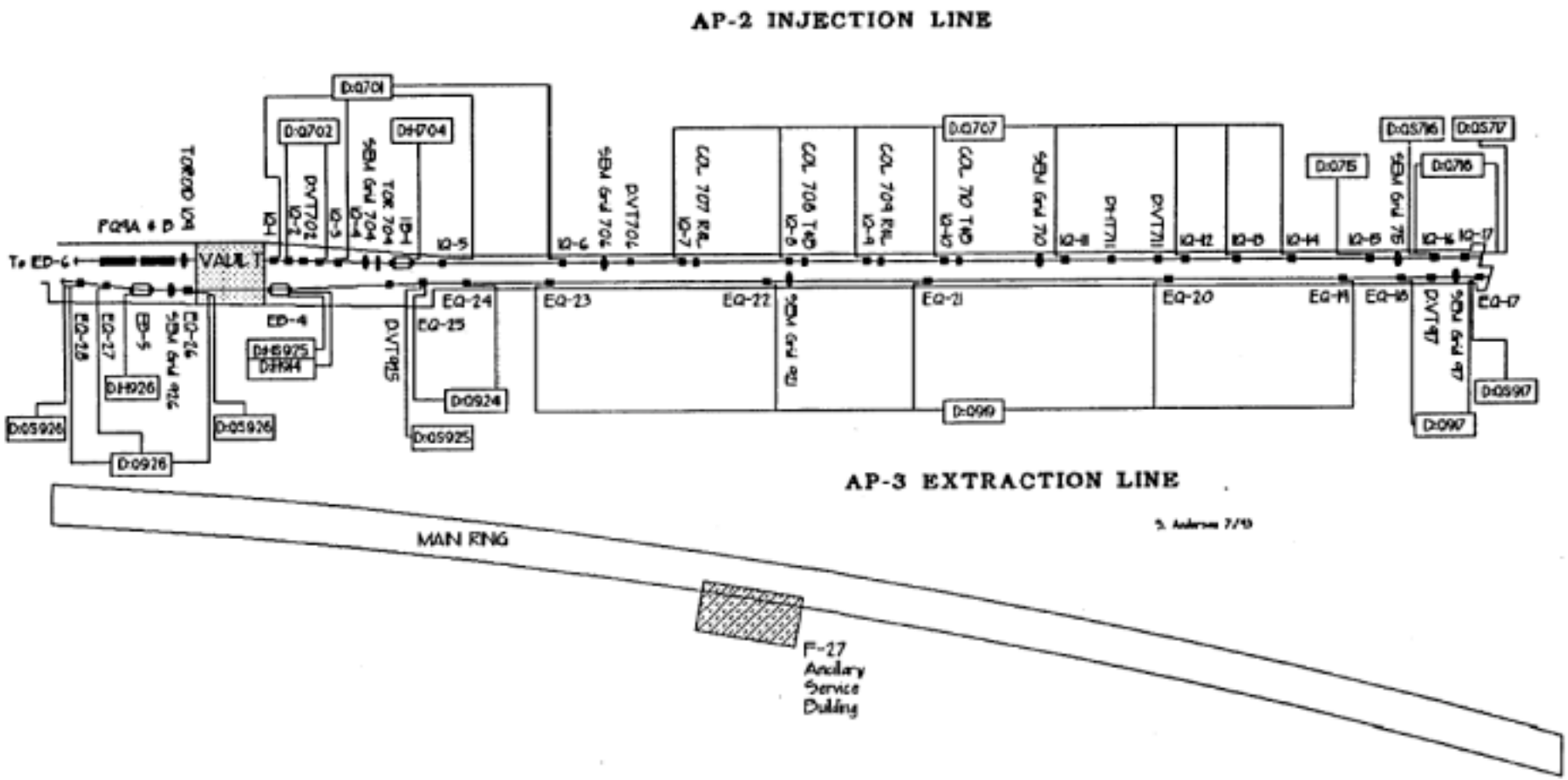
# Antiproton Source



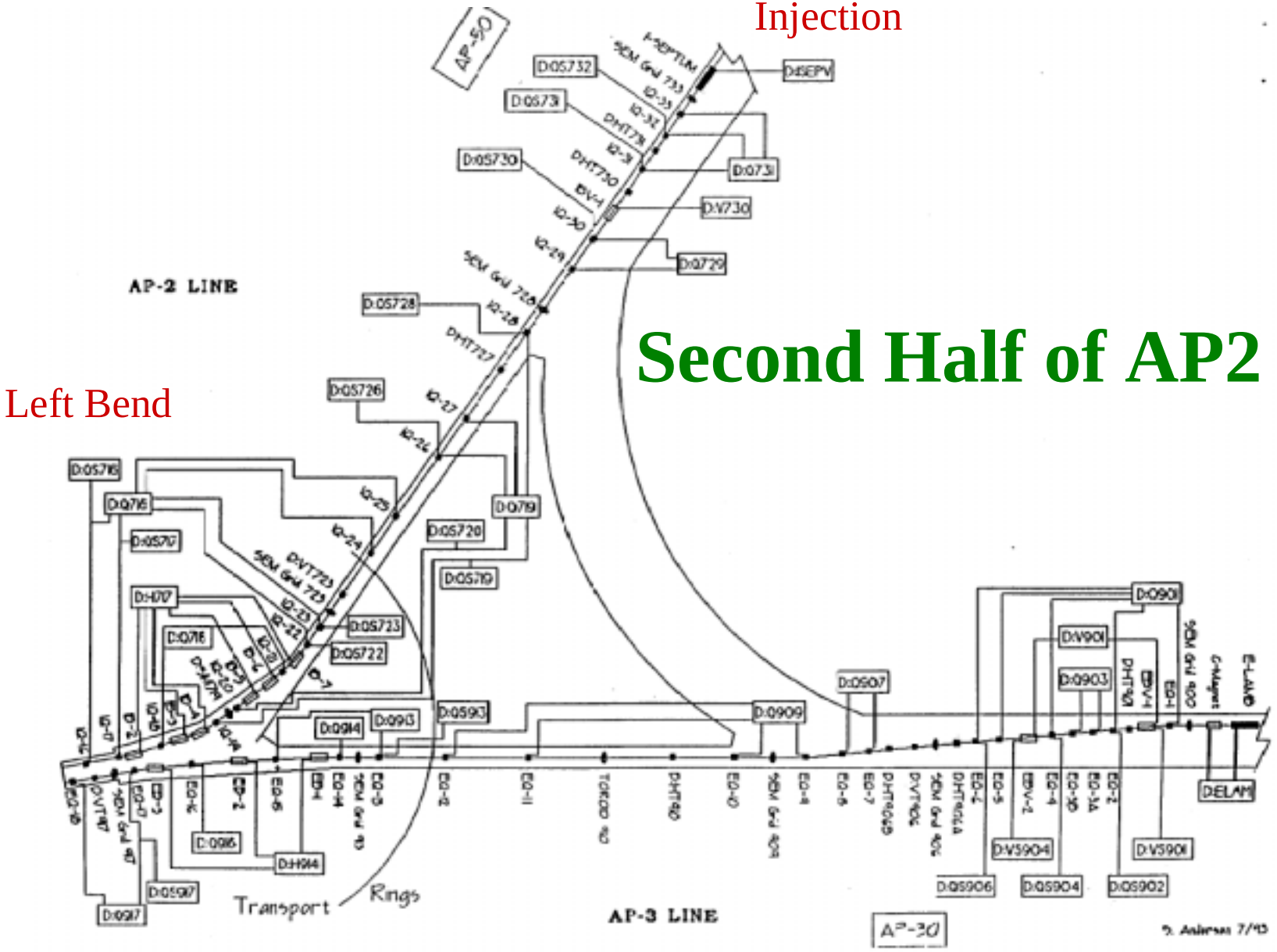
# End of AP1→Target → Lens → AP2 Start



# First Half of AP2

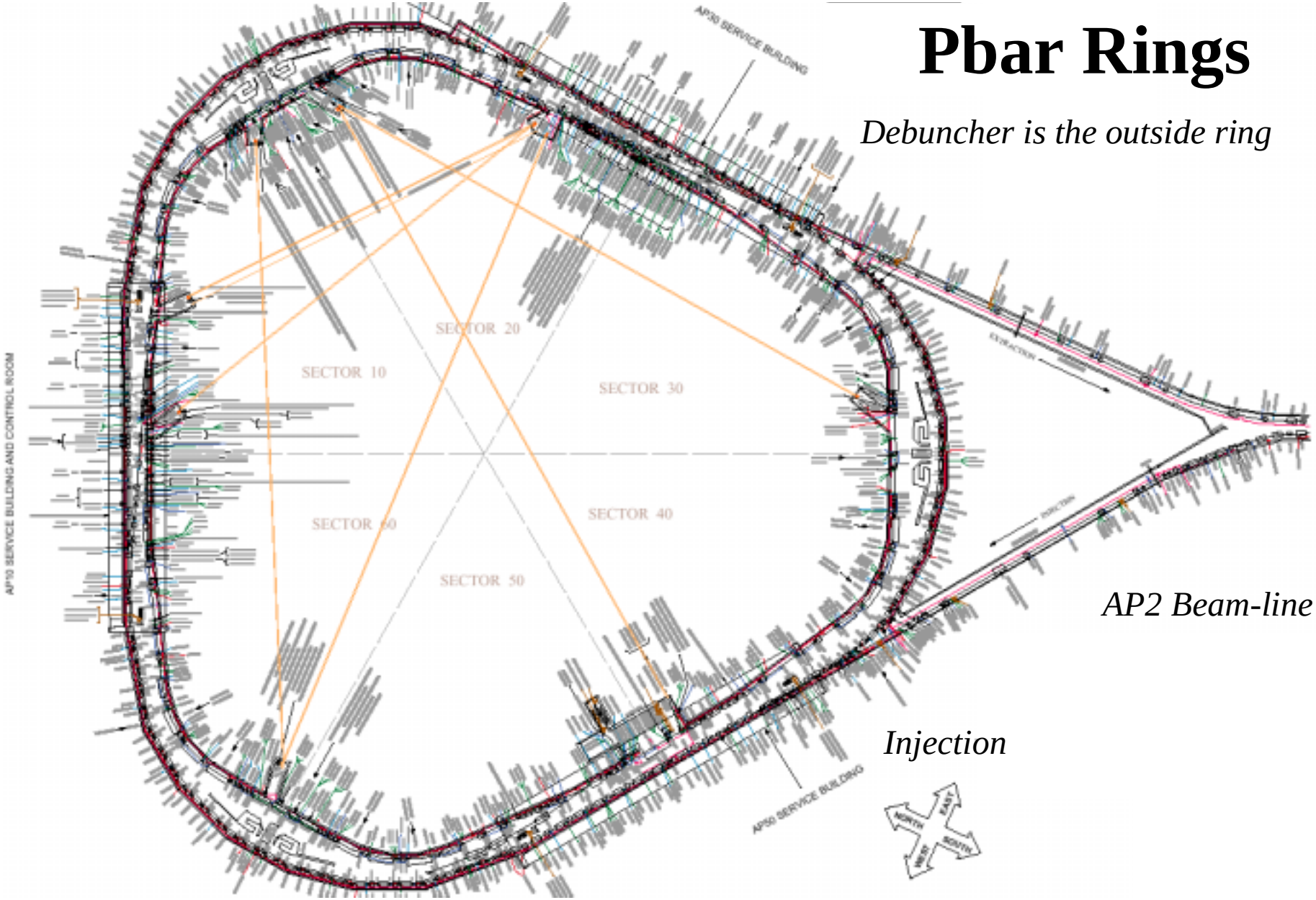


Injection


AP-50
AP-2 LINE
Second Half of AP2
Left Bend
Transport Rings
AP-3 LINE
AP-30

# Pbar Rings

*Debuncher is the outside ring*




*AP2 Beam-line*

*Injection*